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# Effectiveness of Instrument Assisted Soft Tissue Mobilization in Management of Athletes with Gleno-Humeral Internal Rotation Deficit

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## Abstract

**BACKGROUND:** Athletes involved in overhead sports show limited ROM for internal rotation and increased external rotation. This condition of Gleno-humeral internal rotation deficit (GIRD) increases risk of shoulder injuries in athletes and need active management. Current interventions include static stretching, muscle energy techniques and warm-up exercises. Instrument assisted soft tissue mobilization (IASTM) has been hypothesized to lengthen the tissue and improve range by breaking adhesions in soft tissues, there is lack of research showing its effects in athletes with GIRD. This study explores the effectiveness of IASTM in athletes with GIRD following a three week protocol. **METHODOLOGY:** Thirty athletes with GIRD were enrolled in the study by purposive sampling. They received intervention of IASTM with M2T Blade for posterior shoulder musculature and capsule, on alternate days for three weeks. Pre and post-intervention measurements for gleno-humeral ROM for internal rotation, external rotation and horizontal adduction using goniometry; and Apley's scratch test were noted. **RESULTS:** Statistical analysis was done using ANOVA test. IASTM significantly improved ROM for internal rotation from 40.1±5.76 to 74.17±8.28 ($p<0.001$). There was significant improvement in horizontal adduction ROM from 90.47±10.12 to 105.5±8.02 ($p<0.001$). No significant difference was found for external rotation. Statistically significant changes were found on Apley's scratch test as well ($p<0.001$). **CONCLUSION:** Three weeks intervention of IASTM using M2T Blade is effective in improving ranges and flexibility of athletes with GIRD.

***Keywords:*** *Gleno-humeral internal rotation deficit (GIRD), Instrument assisted soft tissue mobilization (IASTM), Apley's test*

## Introduction

Many sports require overhead activities which involve repetitive movements of shoulder joint. It is said that throwers' shoulder must be loose enough to throw but stable enough to prevent symptoms. In order to meet the demand of their sports, there should be delicate balance between shoulder mobility and functional stability, referred to as 'Thrower's Paradox'.[1]

Overhead throwing activities are highly skilful movements performed with extremely high angular velocities.[1] It requires high level muscle activation as reported by EMG studies of shoulder musculature.[2] This overhead act of throwing occurs in 5 phases which include: wind-up, cocking, acceleration, deceleration and follow-through. There occurs transfer of energy from body to throwing arm and the object being thrown, some of which being absorbed by the rotator cuff. Wind-up phase is mainly carried by the activation of deltoid muscle, while subscapularis and pectoralis minor cause the cocking phase[3]. The late cocking and acceleration phase have been shown to create tremendous forces on the anterior shoulder structures[4]. During the follow-through phase, there occurs activation of posterior shoulder soft tissues including supraspinatus, infraspinatus, teres minor and latissimus dorsi.[3] During the deceleration phase, these posterior structures act eccentrically to aid the deceleration of the throwing arm. The entire throwing activity accounts in laxity of anterior shoulder due to stretching and repetitive micro-trauma. However, posterior soft tissue tightness results from eccentric

loading in deceleration[4]. Also, there occur adaptive structural changes and posterior capsulo-ligamentous changes in the shoulder joint.[5]

Because of this, most of the overhead athletes show obvious disparity of movements in dominant throwing shoulder where external rotation (ER) is excessive and internal rotation (IR) is limited when measured at $90^0$ shoulder abduction.[5,6] They also exhibit loss of horizontal adduction in throwing shoulder when compared with non-throwing shoulder.[7] This is referred to as gleno-humeral internal rotation deficit i.e GIRD.[8] The reasons for GIRD could be thickening and scarring of shoulder tissue resulting from the repetitive eccentric loading on posterior shoulder, especially during overhead throwing.[4] Also, external shift of the shoulder occurs resulting in increased external rotation and reduced internal rotation range[9]. One theory suggest that an adaptive increase in humeral retroversion results in increased external rotation and that any considerable internal rotation deficit of more than $20^0$ is related to soft tissue adaptations.[10] In spite of these alterations, the total arc of rotation, measured by ER and IR together, remains similar for both the sides.[1]

These structural adaptations and ROM alterations lead to pathological manifestations like secondary impingement, SLAP lesions and anterior instability of the shoulder and make the shoulder prone to the injuries.[5] Hence there is a need to treat GIRD in overhead athletes in order to prevent further injuries to shoulder. Many researchers have examined the effects of warm-up exercises, thermal modalities and various stretching techniques for improving range of IR.[8] however these techniques have resulted in variable outcomes adding to the confusion that which strategy could help the best.

Instrument Assisted Soft Tissue Mobilization (IASTM) is a simple and practical technique for soft tissue manipulation using specially designed instruments. M2T blade technique is newly emerging form of IASTM which is made of surgical stainless steel. Variation in curvature of the tool has enabled therapist to address specific tissues and anatomical regions providing comfortable grip. It allows therapist to reach at deeper levels of the treatment part of the body than only hands have potential to do. It enables to detect and treat soft tissue lesions by using variety of multidirectional stroke techniques over involved soft tissue structures[11]. The efforts put by the therapist are minimized because of the surfaces of the instruments used but it maximizes the force delivered to the tissues.[1]

**Image 1 M2T Blade**

The M2T Blade (Image 1) is reported to increase the blood flow, facilitating supply of blood and oxygen to the area under treatment. It restarts the healing process by producing localized inflammation. It improves the fascial mobility, proliferation of extracellular matrix fibroblasts, mast cells production and phagocytic activity. Also, it has positive impact on re-synthesis, organization and maturation of collagen. It improves extensibility of the soft tissues by breaking the adhesions, thickenings, fibrotic nodules and scar tissue. Heat generated in the tissue due to the strokes applied by the instrument reduces the viscosity making the tissue softer; ultimately leads to improvement in range of motion.[13]

Thus, IASTM is not only effective in treating myofascia but also can stimulate tendons and other soft tissues like muscles to improve its function[13]. Literature review suggests that IASTM has been proven to be effective in treatment of soft tissue extensibility dysfunction[12], compartment syndromes[13] chronic low back pain[14], plantar fasciitis[15], and also on shoulder pain in badminton players[16]. But there is lack of researches done which will show its effectiveness on shoulder ROM in overhead athletes.

This study explores the effectiveness of IASTM technique using M2T blade on shoulder ROM in athletes exhibiting gleno-humeral internal rotation deficit. It is hypothesized that athletes with GIRD would exhibit improved ROM for internal rotation and horizontal adduction following 3 weeks of IASTM treatment.

## Methodology

Thirty professional athletes (20 males, 10 females) aged 18 to 30 years, involved in overhead sports like tennis, badminton, basketball, cricket etc, participated in the study. All had played at least till district level. Inclusion criteria was loss of minimum $20^0$ range for internal rotation when measured at $90^0$ shoulder

abduction, and minimum 5cm distance between finger tip and body landmark on Apley's scratch test. Subjects who had shoulder injury or underwent any surgery for dominant upper extremity in last 6 months were excluded from the study. After an informed consent, they were enrolled. The protocol was approved by the Sub-Ethics Committee of the Institute.

Measurements for gleno-humeral ROM and Apley's test (Image 2) were taken before and after 3 weeks of intervention. Treatment with M2T blade was given with the participants in sitting position. Any adhesions or restrictions were assessed with the blade itself. Direction which elicited more resistance to the blade strokes was used for the first part of the treatment, followed by the opposite strokes. Treatment area included muscle fibres of posterior deltoid, latissimus dorsi, infraspinatus, supraspinatus, posterior joint capsule and around medial border of the scapula.

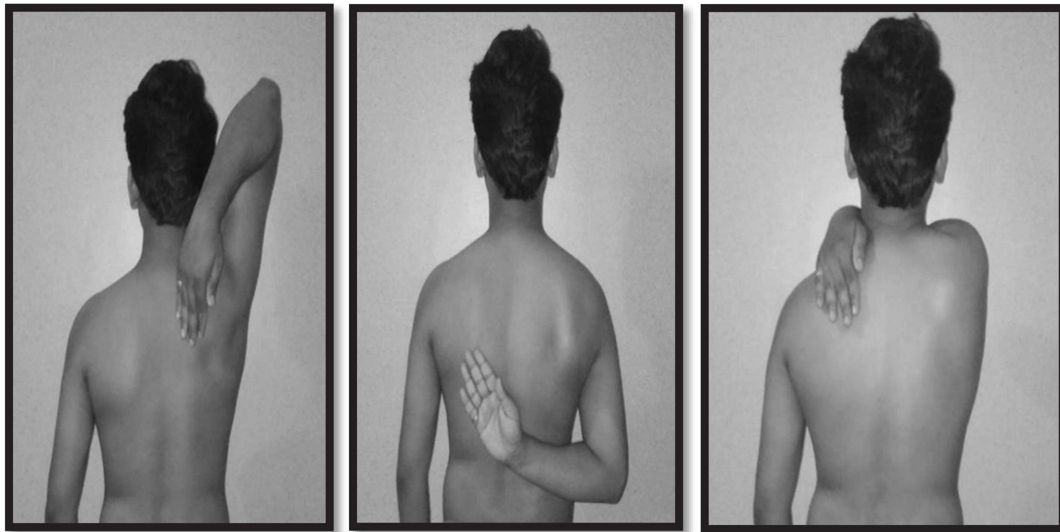

**Image 2 Apley's scratch test**

Around 30-45 strokes were applied for each area with M2T blade angled at $45^0$ and pressure as tolerated by the subject. Each session was completed in approximately 15 minutes and repeated 3 times a week for 3 weeks. Participants were asked to apply ice for 10 minutes to treatment area, for reducing soreness and redness. Measurements were recorded after the first session and at the end of every week.

## Results

Data was analysed using SPSS Version 16.0. Repeated measure ANOVA was used to test the changes in pre- and post-measurements of the outcomes over the time of the study. All statistical analyses were tested at the 0.05 level of significance.

Mean age of the subjects involved in the study was 24.93 ±2.59. Table 1 provides summary about the athletes involved in study and their sporting activities.

**TABLE 1 Sports-wise categorization of the subjects**

| SPORTS | NUMBER |
|---|---|
| Badminton | 16 |
| Tennis | 3 |
| Cricket | 4 |
| Basketball | 4 |
| Volleyball | 2 |
| Handball | 1 |
| **TOTAL** | 30 |

As seen from table 2, athletes showed significant improvement in ROM for internal rotation and horizontal

adduction, following 3 weeks of treatment with M2T blade. The mean range of IR changed from 40.1±5.76 at baseline to 74.17±6.28 at the end of 3rd week, which was statistically highly significant ($p<0.001$ and f=224.6). There was no significant difference found for ER ROM. But range for horizontal adduction improved significantly from 90.47±10.12 at baseline to 105.5±8.02 at the end of 3rd week. The results obtained were highly significant ($p<0.001$, f=60.39). There was no significant difference found between 2nd and 3rd weeks of treatment but appreciable change was noted..

**TABLE 2 Gleno-humeral ranges of motion for internal rotation, external rotation and horizontal adduction (mean ± SD in degrees) before and after the 3 weeks of treatment.**

| Session | Internal Rotation | External Rotation | Horizontal Adduction |
|---|---|---|---|
| Pre treatment – Session 1 | 40.1±5.76 | 108.03±11.27 | 90.47±10.12 |
| Post treatment – Session 1 | 50.87±5.29 | 108.97±7.69 | 96.03±9.95 |
| Post treatment – Session 3 | 65.2±4.86 | 112.33±6.67 | 101.8±9.00 |
| Post treatment – Session 6 | 73.57±7.69 | 111.8±5.79 | 103.9±7.34 |
| Post treatment – Session 9 | 74.17±6.28 | 112±5.68 | 105.5±8.02 |
| *p*-value | <0.001 | 0.054 | <0.001 |

As seen from table 3 below, participants also showed significant improvements in reducing the distance between tip of middle finger to the stated landmark on all three positions of Apley's test. The distance of 11.52±2.99 at the baseline for reaching over the head reduced to 4.53±2.61 post 3 weeks treatment. Also for reaching behind the back and across the body, the distances reduced from 9.23±2.52 to 3.26±1.81 and from 7.39 ±1.68 to 2.84±1.44 respectively, which were highly significant ($p<0.001$).

**TABLE 3 Mean differences in the distances reaching over the head, behind the back and across the body on Apley's test before and after 3 weeks of the treatment**

| Session | Over the head | Behind the Back | Across the Body |
|---|---|---|---|
| Pre treatment – Session 1 | 11.52±2.99 | 9.23±2.52 | 7.39±1.68 |
| Post treatment – Session 1 | 9.47±2.77 | 7.33±2.44 | 5.92±1.48 |
| Post treatment – Session 3 | 6.64±2.79 | 4.89±1.61 | 3.86±1.06 |
| Post treatment – Session 6 | 5.15±2.82 | 3.83±1.76 | 3.22±1.34 |
| Post treatment – Session 9 | 4.53±2.61 | 3.26±1.81 | 2.84±1.44 |
| ***p*-value** | **<0.001 '** | **<0.001'** | **<0.001'** |

## Discussion

Shoulder of overhead athlete has to face tremendous forces and high speed torque during throwing activities in sports. This places the shoulder under extreme stresses, leading to soft tissue and bony changes which take place over time. These athletes exhibit alterations in ranges of motion as well. Studies have shown that athletes involved in overhead throwing activities display increased range for external rotation and reduced range of internal rotation at gleno-humeral joint. GIRD results due to tightness of posterior shoulder structures, capsule contracture, and osseous adaptations of humeral head and/ or glenoid due to repetitions of activities for longer time.[9] GIRD is proven to be associated with increased occurrence of shoulder injuries in athletes.[5] Many researchers have studied the effects of various treatments in order to reduce the risk of shoulder injuries by correcting GIRD.

Studies have examined effects of stretching and manual therapy in improvement of gleno-humeral ROM among athletes. Sleeper's stretch helps in increasing range of gleno-humeral horizontal adduction and internal rotation.[17] Sleeper's stretch also significantly reduces recovery time.[18]

GIRD is more prevalent in athletes who don't do regular stretching exercises.[9] Static stretching applied for 90 seconds to posterior deltoid in elite swimmers

resulted in significant improvement in internal rotation.[19] Another variation of IASTM- the Graston technique helps increase the ROM and prevent further loss in ranges at dominant shoulder.[8]

IASTM is an approach for manipulation of soft tissues using an instrument that is made of surgical stainless steel. It helps releasing scar tissue, breaking adhesions and removing fascial restrictions. Using the M2T blade, therapists can not only localize and treat adhesions in soft tissues, but identify and address thickenings, fibrotic nodules, scar tissues and crystalline deposits more accurately[20]. It allows the therapist to reach to the deeper levels of the body where the hands cannot. Addressing specific tissues and the anatomical regions by individualizing the treatment is made easy by the variations in curvature of the tool.[20]

IASTM restarts the inflammatory process by producing localized micro-trauma to soft tissue, thereby causing capillary and micro-vascular haemorrhage and stimulated the healing and reparative response.[21]

## Conclusion

The application of IASTM using M2T Blade on alternate days for 3 weeks to posterior shoulder muscles and capsule produced significant increase in both internal rotation and horizontal adduction ROM. Also, it improved flexibility of the shoulder musculature when measured on Apley's scratch test. This study concludes that IASTM using M2T Blade is effective in treating athletes with gleno-humeral internal rotation deficit improving the ranges and flexibility at dominant shoulder.

**Conflict of Interest:** Nil

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**Ethical Clearance:** Taken from Institutional Sub-Ethics Committee of Dr. D. Y. Patil College of Physiotherapy, Pune.

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